TRAINING DOCUMENT

TITLE:	**Overview of Recent Federal Nuclear Detonation Response Planning**
REQUIREMENT:	Personnel will be informed of the current improvised nuclear detonation response planning activities within the federal government.
TARGET GROUP:	Radiological emergency responders and planners at the local, state and federal levels
TIME ALLOTTED:	30 minutes
METHOD OF INSTRUCTION:	Presentation

Prepared by: *Brooke Buddemeier, CHP, Lawrence Livermore National Laboratory*
Erika Olsen & Shaida Arbabha, DHS Scholars at LLNL
Date: *July 2011*

Please provide feedback for these draft documents to brooke2@llnl.gov

If using parts of this presentation or the information contained in the presentation, please cite:
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Instructional Goal

To orient emergency response personnel on current improvised nuclear detonation response planning activities within the federal government.

Instructional Objectives

1 Congress identified IND response planning as a priority and part of all-hazards response planning.

2 IND analysis indicates significantly reduced prompt radiation and thermal effects from cold war planning.

3 Identify federal IND specific response guidance.

4 Understand that State and local planning is critical to reducing initial loss of life.

At the completion of training, the trainee will be familiar with:

The federal government efforts and involvement in improvised nuclear detonation response planning, and the new federal guidance and planning tools available to State and local emergency responders.

Materials

A "Desk Reference" copy of the references below would be advisable

Visual Aids

Charts, photographs, and videos explaining improvised nuclear detonations

Handouts

Student Guide for **Overview of Recent Federal Nuclear Detonation Response Planning**

References

Recent research over the last few years has help greatly improve our understanding of appropriate actions for the public and responder community to take after a nuclear detonation. Much of this research was recently highlighted in a National Academies Bridge Journal on Nuclear Dangers. This research points out the potentially misleading shelter / evacuation conclusions that can be drawn from using oversimplified modeling assumptions (a.k.a circles of prompt effects and cigar shaped Gaussian fallout patters using surface wind conditions).

Planning Guidance:

Planning Guidance for Response to a Nuclear Detonation. Developed by the Homeland Security Council, 2nd Ed, June 2010. This interagency consensus document provides excellent background information on the effects of a nuclear detonation and key response recommendations. Its definition of zones (damage and fallout) are becoming the standard for response planning and should be integrated in the planning process.

National Council on Radiation Protection and Measurement (NCRP) Report No. 165 - Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers was released Feb 2011 and is a National Standard that supplies the science and builds on many of the concepts of the Planning Guidance.

For public Health information, an entire edition of the journal for Disaster Medicine and Public Health Preparedness was dedicated to the public health issues associated with the aftermath of nuclear terrorism. All of the articles are available for free download from the highlighted link.

DHS Strategy for Improving the National Response and Recovery from an IND Attack, April 2010, is an Official Use Only document that breaks the initially overwhelming IND response planning activity down into 7 manageable capability categories with supporting objectives. This can be a valuable document to guide a state and regional planning process as a lot of work has already gone into time phased capability requirements for Doctrine/Plans, Organization, Training, Materiel, Leadership, Personnel, Facilities, and Regulations/Authorities/ Grants/Standards. Please contact Dave Sheehan, David.Sheehan@FEMA.gov or 202-212-1608 for more information or a copy of the document

The 30 minute video, Reducing the Consequences of a nuclear detonation is available on YouTube (click the title to view) and shows a presentation given last year at an LA County Public Health Conference. It provides a lot of information on DHS IND response planning research and demonstrates the very dynamic nature of an IND event. It was developed to provide “ground level” points of view and demonstrate the timing of the event and the consequences of different actions.

Key Response Planning Factors for the Aftermath of Nuclear Terrorism developed by Lawrence Livermore National Laboratory in support of the DHS preparedness activity was released in August 2009 reviews the science behind many of the recommendations noted in the video and above doctrine.

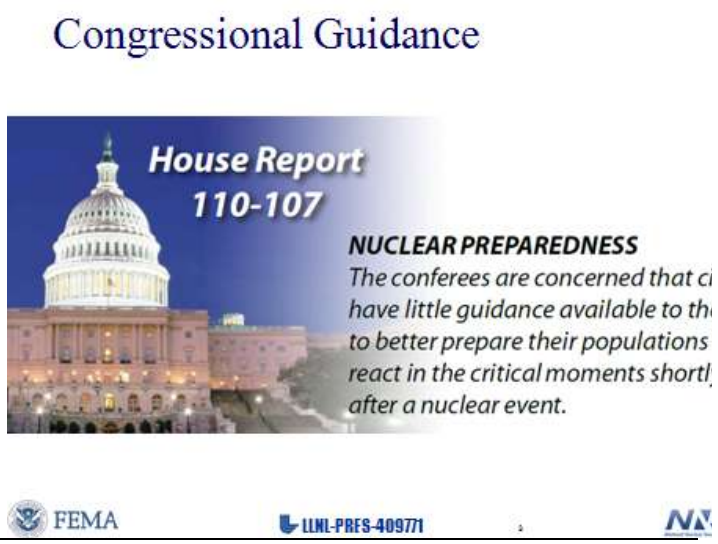
Trainee Preparation

None

0- INTRODUCTION – Introduce Presenter and summarize experience and qualification	
Title This presentation is an overview of current Improvised Nuclear Detonation response planning activities within the federal government. This material was prepared for DHS by Lawrence Livermore National Laboratory. For more information contact Brooke Buddemeier.	
1- IND response planning is a priority	
IND Response Fundamental Part of Federal Response Planning Since the inception of the Department of Homeland Security, nuclear terrorism has been considered as one of the 15 national planning scenarios which have been the foundation for key response task and capability identification. The National Response Framework (formally the National Response Plan) has incorporated aspects of nuclear terrorism response planning in the Nuclear / Radiological Incident Annex. The Federal register publication of "Preparedness Directorate; Protective Action Guides for Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents" on January 3, 2006 (updated August 1, 2008) has been expanded on with the January 2009 Planning Guidance for Response to a Nuclear Detonation" which was updated in June 2010.	

Project Background

The Federal Budget Supplemental in FY07 provided funding to the DHS Office of Health Affairs to support IND response planning. Congress has continued to provide funding to FEMA in the FY09 and FY10 budget cycles.



Communication Strategy

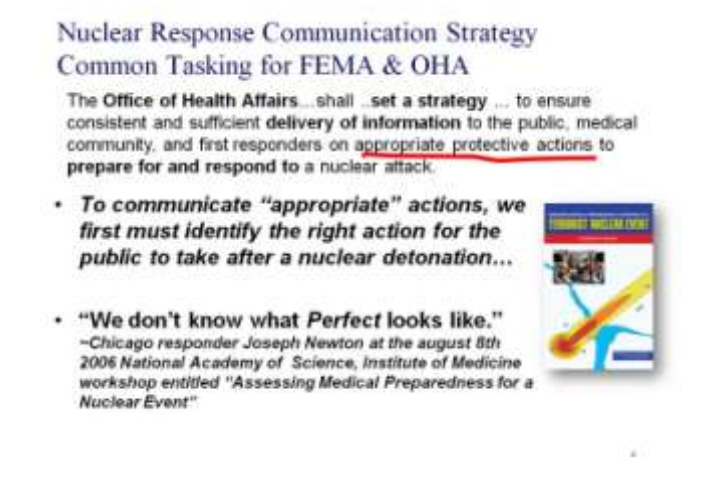
One of the key tasks in this effort is to develop a communication strategy. As daunting as that task is, it could not begin until appropriate actions could be defined that we could communicate

- **Click – Appropriate Actions (underlined)**

...Unfortunately there is not currently consensus of what the right thing to do is,

- **Click – Chicago Responder Joe Newton summed it up nicely; "we don't know what perfect looks like"**

Describing the fact that many response organizations (at the federal, State, and Local level) don't even have an idea of ***what should be done***, much less what to expect from such an event.



Lack of Scientific Consensus

There also appears to be a lack of scientific consensus on the appropriate actions to take after a nuclear detonation. The recommendations of the Department of Homeland Security's ***Ready.gov***, which are consistent with the recommendations of the National Academy of Sciences[i], were recently criticized by the Federation of American Scientists[ii] because of conflicting recommendations with a RAND study[iii] [iv].

Work needs to be done to update our Cold War guidance to address the asymmetric threat we now face. Both our society and our cities have changed significantly over the last half century and new preparedness guidance is required.

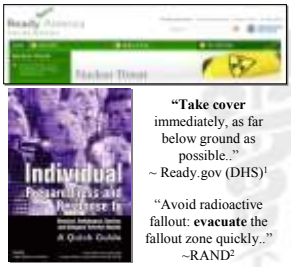
Ready.gov recommends **"Take cover** immediately, as far below ground as possible.." but RAND recommends "**evacuate** the fallout zone quickly.."

We cannot afford to have this kind of conflicting guidance in the critical time period right after the detonation.

[i] National Academy of Sciences, 2005, Nuclear Attack, factsheet created for News and Terrorism: Communicating in a Crisis.
[ii] Federation of American Scientist, 2006, Analysis of Ready.gov. Available online: http://www.fas.org/reallyready/analysis.html.
[iii] Davis, L., LaTourrette, T., Mosher, D.E., Dais, L.M., & Howell, D.R., 2003, Individual Preparedness and Response to Chemical, Radiological, Nuclear, and Biological Terrorist Attacks [Electronic version]. Arlington, Virginia: RAND Corporation.
[iv] Orient, J., May 2005, Unready.gov. Civil Defense Perspectives, 21(4). Retrieved June 23, 2006, from http://www.oism.org/cdp/may2005.html.

Lack of Scientific Consensus on Appropriate Actions

- Conflicting advice on basic issues such as ***shelter or evacuate?***
- Many Cold War Civil Defense assumptions are invalid for nuclear terrorism.
- Updated analysis and planning low yield nuclear detonations in modern cities is required.



"Take cover immediately, as far below ground as possible.."
~ Ready.gov (DHS)[1]

"Avoid radioactive fallout: **evacuate** the fallout zone quickly.."
~RAND[2]

Homeland Security

[1]US Department of Homeland Security, http://www.ready.gov/america/beinformed/nuclear.html
[2]Individual Preparedness Response to Chemical, Radiological, Nuclear, and Biological Terrorist Attacks: A Quick Guide Lynn E. Davis, Tom LaTourrette, David E. Mosher, Lois M. Davis, David R. Howell 30 pp. • 2003 • ISBN: 0-8330-3487-1

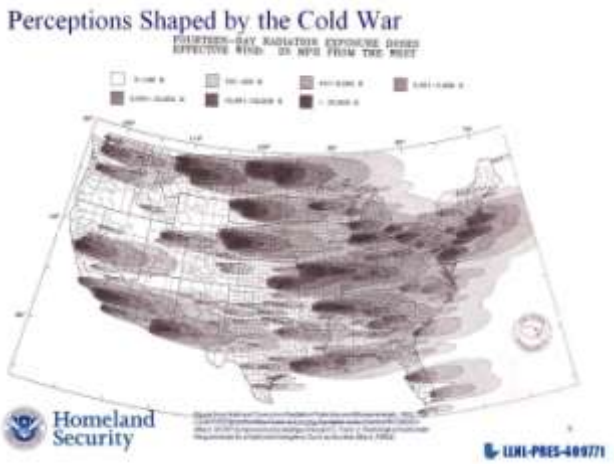
2- Effects are reduced from cold war planning

Perceptions Shaped by the Cold War

The Cold War specter of strategic thermonuclear war and mutually assured destruction, with the possibility of hundreds of nuclear strikes on our major cities and the majority of the United State covered with lethal fallout is thankfully greatly diminished. However, the possibility of nuclear terrorism still conjures the same sense of Armageddon.

This map represents the aftermath of nuclear war, with the shaded areas on the map representing fallout radiation levels that would be enough to injure or kill the people that remain outdoors.

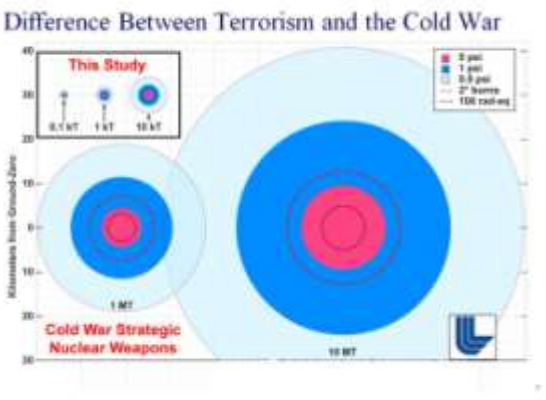
Many considered the cold war event to be so catastrophic that local response planning may be useless. Which has led to a misguided impression that the low yield detonation of an nuclear terrorist attack would lead to the same consequences and there would be no local response capability left to save and sustain lives. Without planning, this might be a self fulfilling prophecy with hundreds of thousands of additional potential casualties as a result.



Difference between Terrorism and the Cold War

This graphic compares the relative size of the prompt effects from both Cold War strategic nuclear weapons and improvised nuclear weapons analyzed in this study.

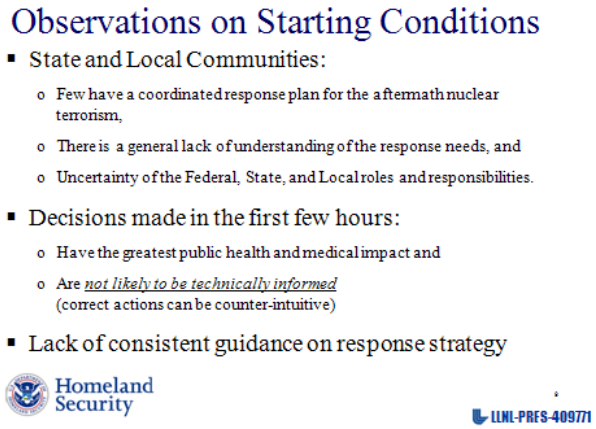
Also, unlike the Cold War, we are using a ground-level detonation.



Observation from the Workshops

These are some observations from workshops that were conducted with response organizations from across the United States.

Few State and Local Communities have a coordinated response plan for the aftermath of nuclear terrorism, and there is a general lack of understanding of IND technical issues and response strategies. A key roadblock is uncertainty of the Federal, State, and local roles and responsibilities in responding to the aftermath of an IND. For example, some local participants presumed federal responders would lead the initial response to a nuclear event. Unfortunately, decisions made in the first few hours have the greatest public health and medical impact and will probably *not be technically informed.* Correct actions, such as taking shelter, can often be counter-intuitive. There is a lack of scientific consensus on response strategies.



MACWG

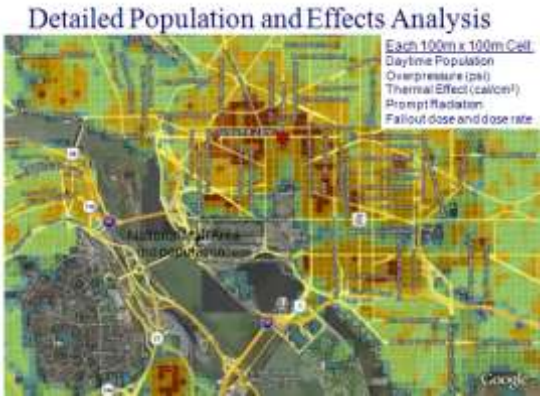
- To help address the lack of scientific consensus, the Department of Homeland Security established a scientific working group called the IND Modeling and Analysis Coordination working group or "MACWG" for short.
- Comprised of the technical organizations that support federal government agencies, this group is working to collaborate and come to consensus on as many issues as possible to support IND response planning.
- The MACWG has 3 key objectives:
  1. Establish a scientific consensus (where possible) on the IND effects and issues
  2. Bound uncertainty and identify unknowns
  3. Deconflict recommended IND response actions.

3- Analysis of IND Effects

Advanced Detailed Analysis

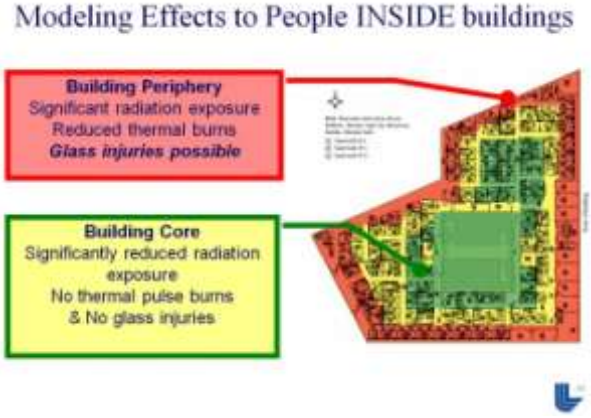
Detailed urban information combined with advanced modeling capabilities has resulted in unprecedented improvements in the understanding of nuclear detonation effects in a modern urban environment. For example, detailed day and night time population density and 3-dimensional urban terrain modeling have allowed for an unprecedented, “block by block,” analyses of nuclear detonation effected in the urban environment. Each 100m x 100m block in a city can be evaluated for the prompt blast, thermal, and radiation effects. Fallout arrival and decay can also be evaluated in each block of a city, allowing for unprecedented community specific response strategy optimization analysis.

Building specific information can provide detailed injury assessment to provide for advanced public health response planning.



Modeling the Effects of Buildings

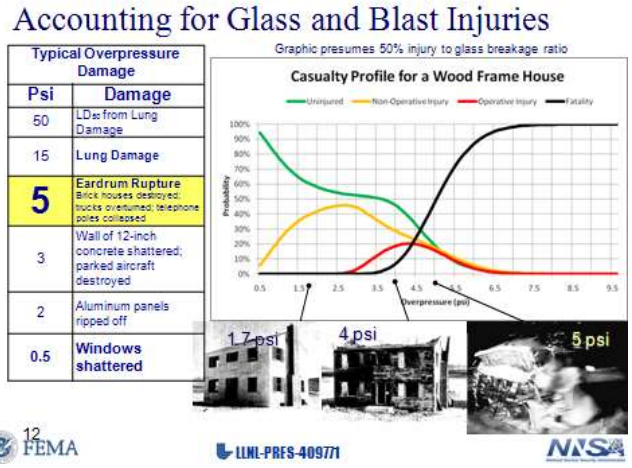
Buildings can both protect and injure their occupants from the effects of a nuclear weapon. In addition to modeling how modern urban buildings interact with blast effects, the distribution of personnel within building is being evaluated for an overall injury assessment.
Commonly used modern models do not consider the import and effect building have on protecting the population from prompt effects, often making the assumption that the city population is outdoors to calculate prompt and fallout effects. Updated work from DHS Science and Technology and Health and Human Services has dramatically changed injury assessments by including the potential effects of Urban building on the population



Blast and glass injury

Current models for human effects from blast stop at 5 psi, yet you can see from the image a house at 5 psi can be easily destroyed. ***I think whoever is in a house like that just might get more than an eardrum rupture***. Advanced modeling now accounts for the collapse, severe damage, or glass breakage to the structure and the subsequent effects on the occupants.

Recent analysis work helps us to better understand the relationship between people and the urban environment. Most of the injuries outside of the Murrah building in the 1995 Oklahoma City bombing were caused by glass injury, not direct blast effects. NATO medical response planning documents for nuclear detonations state that "… missile injuries will predominate. About half of the patients seen will have wounds of their extremities. The thorax, abdomen, and head will be involved about equally." A significant number of victims from Hiroshima and Nagasaki arriving at field hospitals exhibited glass breakage injuries, but this effect has not been previously modeled.

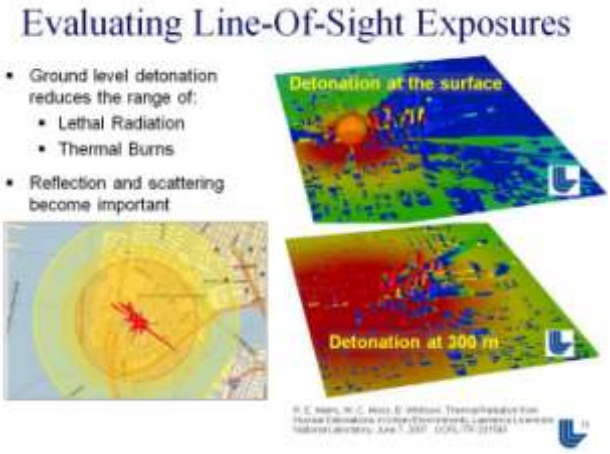


Evaluating Line of Sight

The upper image is that of a 10kT detonation 300m over the OK city bombing site and the potential areas of thermal injury form the "flash" of heat produced by the fireball You can see how the injury areas do mimic "perfect circles" of effect.

Click- The bottom right image represents the SAME yield at the SAME location, but this time it is a surface burst. The image demonstrates how much of the thermal energy from that fireball is blocked by the urban environment. The areas of green and blue on the map represent areas of little thermal injury.

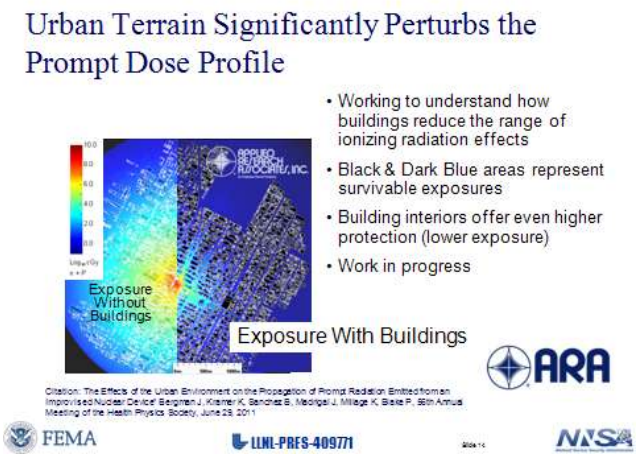
Click - Evaluating the line of sight exposures in the urban environment demonstrates a reduction in the number of previously calculated burns that have been cited in many previous studies. When we compare the actual thermal



impacts, it may look less like the perfect circles to the left and more like the "splatter" graphic in the center.

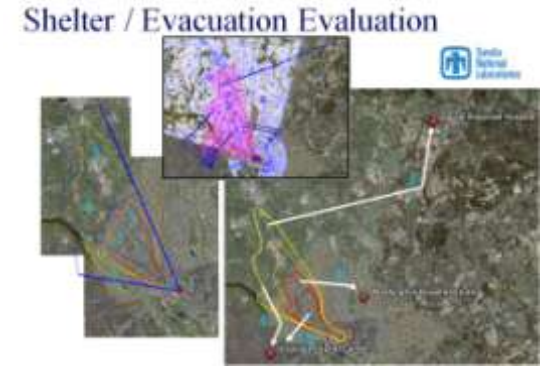
Advanced Radiation Analysis

Models developed at Applied Research Associates (ARA) and Los Alamos National Laboratory have shown similar reductions in injuries from the initial radiation produced in the first minute of a nuclear explosion. The figure demonstrates the nonsymmetrical reduction in radiation exposure by the urban environment. The left side of the image represents an unobstructed exposure from a 10kT surface detonation as compared to the reduction of outdoor radiation levels indicated in the right side of the image. Like the thermal analysis, these studies indicate that the ambient radiation levels from a low-yield, ground-level nuclear detonation in an urban environment could be significantly reduced. For example, the unobstructed range for a potentially lethal radiation exposure of 400 rads (cGy) is about 1,200 yards. Initial results by ARA indicate that the range might be reduced by as much as half, down to 500 to 700 yards from the detonation point in highly built-up areas.



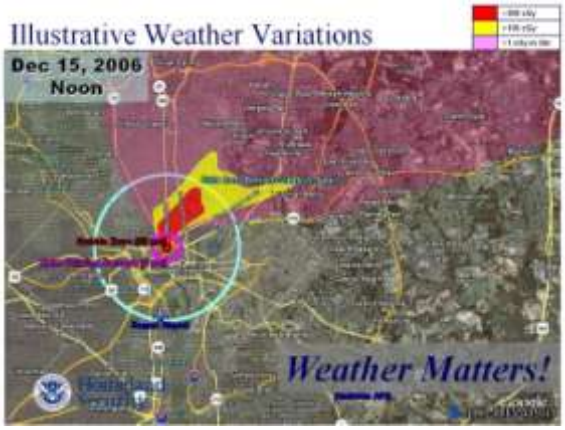
Shelter / Evacuation

As previously demonstrated, the shelter and evacuation strategy will likely be the most relevant analysis in regards to the appropriate response. New analysis and tools developed at Sandia National Laboratory take the detailed 100mx100m prompt and fallout analysis files generated at Lawrence Livermore National Laboratory and provide community specific shelter and evacuation optimization analysis.



Weather Matters

Another key advance in recent decades is the ability to do 3-dimensional weather modeling. Previously, simple fallout models assumed uniform wind direction and speed at all levels of the atmosphere. This resulted in "Gaussian" fallout patterns (that is the classic "cigar" shape) that gave an unrealistic impression that fallout was conveniently confined to long, narrow patterns, like…



Click – January Fallout pattern

…this fallout pattern from noon on Jan 15th 2006. Unfortunately the heat of a nuclear explosion will drive the fallout cloud several miles into the upper-atmosphere. Real atmospheric conditions often have different wind direction and speeds at different heights.

As a demonstration of weather variability, I will show you the fallout patterns for the 15th of each month in 2006 using the 3-dimensional weather analyses. Observe the variability of weather patterns and directions.

Click – begin animation

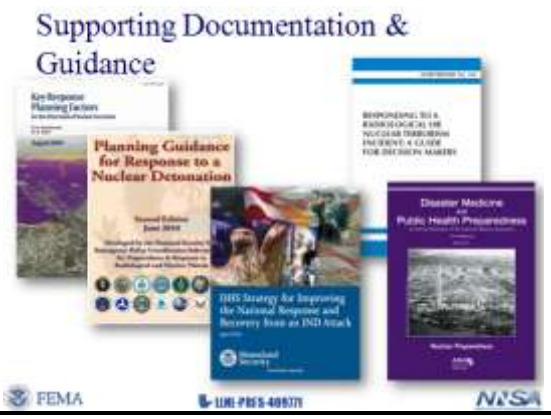
Point out how many "Gaussian" patterns there are (count ~ four of them.. the ones where the red portion does not diverge)

More information on recent advances in IND effects can be found in the National Academies Bridge Journal.

4- State and Local Preparedness

Informing National Response Strategies

See the references section of this instructor guide for a description of each of these documents



National Laboratory Support to State and Local Interactions

A critical element of our state and local interactions is using the National Laboratories to provide understanding and context for an IND event in a specific community through…

Click -

Details on effects specific to them by providing their community's potential casualties, infrastructure effects, and response issues

Click – Visualization Aids…

was a key request by responders trying to understand the event. They are tired of "plume maps" providing an abstract view of an image that they won't see for days during a real event, rather...

"How will the event appear to me?"

SUMMARY

A. Restate the major learning objectives